Application No. 09/682,142 RD-28314 #19

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

SIVAVEC et al. Group Art Unit: 3673

Application No.: 09/682,142 Examiner: Katherine W. Mitchell

Filed: July 26, 2001

For: PERMEABLE-REACTIVE BARRIER MONITORING METHOD AND SYSTEM

APPEAL BRIEF TRANSMITTAL

Honorable Commissioner of
Patents and Trademarks
Alexandria, VA

Sir:

Attached are three (3) copies of BRIEF ON APPEAL in the above-identified application and Credit Card Payment Form authorizing charge of the amount of $ 320 in payment of the required fee. Please credit or debit Deposit Account No. 500917 as needed to ensure consideration of this BRIEF. Two duplicate copies of this paper are attached.

Respectfully submitted,

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9/6, 2003

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BRIEF ON APPEAL

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TABLE OF CONTENTS

I. INTRODUCTION

This is an appeal from an office action mailed April 23, 2003 finally rejecting claims 1 to 35 and 44 to 66. No claims were allowed.

A. Real Party in Interest

The applicants and the assignee of the entire interest, General Electric Company, Schenectady, NY, are the real parties in interest.

B. Related Appeals and Interferences

There are no related appeals or interferences.

C. Status of Claims

Claims 1 to 35 and 44 to 66 are pending, stand rejected and are on appeal. Claims 36 to 43 are canceled. The claims on appeal are set forth in the attached Appendix. Claim 1 is an independent claim and claims 2 to 22 depend from claim 1. Claim 23 is an independent claim and claims 24 to 35 depend from claim 23. Claim 44 is an independent claim and claims 45 to 65 depend from claim 44. Claim 66 is an independent claim.

D. Status of Amendments

No amendments were filed subsequent to Final Rejection .

II. SUMMARY OF INVENTION

The invention is a Permeable Reactive Barrier ("PRB") method and system for treating contaminated ground water.

A "pump-and-treat" method is a conventional approach for remediating contaminated ground water. In a pump-and-treat, contaminated water is extracted from groundwater, treated above ground and re-injected or discharged back into the groundwater. A pump-and-treat method disrupts natural groundwater flow by diverting the ground water to the surface for treatment.

In contrast, a PRB is a passive method that depends upon "natural groundwater flow" for effectiveness. In a PRB, a barrier of reactant materials is placed in the path of a naturally spreading plume of groundwater contaminants. If the PRB is properly placed with respect to the spreading plume and if the PRB is properly oriented and designed, the barrier will effectively intercept the plume and impart a residence treatment time to adequately treat the plume contaminants before the plume has passed through the barrier. Applicants' specification states:

> A PRB is designed to provide a set residence time for decontamination of the contaminated plume. The PRB design is determined by the concentration of contaminants, the natural groundwater flow and the degradation rate for the contaminants in the presence of the PRB reactive material. A wide variety of chlorinated hydrocarbons, including chlorinated ethenes such as trichloroethene (TCE) and tetrachloroethene (PCE) and their products, dichloroethene (DCE) and vinyl chloride (VC), are effectively treated by this method, often at a significant cost savings when compared to conventional pump-and-treat alternatives.

Specification paragraph [0004].

In a first embodiment, the invention is a monitoring method and system **10** that avoids well purging and interruption of groundwater natural flow and consequential sampling and process error. According to the invention, the method comprises conducting a PRB treatment of a contaminated aqueous medium, in-well monitoring by sensing effectiveness of the PRB treatment to generate a signal representing a characteristic of the sensed effectiveness and in-well transmitting the signal by a wireless communication to a remote collector **22** or monitor. (claim 1). In well monitoring is imperative to maintaining the PRB passivity. Additionally," in-well" "wireless transmitting" eliminates disruption to flow caused by wiring and wire conduits required to transmit prior art monitoring samples or signals to ground surface.

In an embodiment, the invention is a method of treating a contaminated groundwater, comprising sensing a characteristic of the contaminated groundwater with a sensor **34** placed in at least one well **14** emplaced substantially along a transect of a longitudinal axis of a PRB zone **12** and remotely monitoring the sensing to determine effectiveness of a remediation treatment of the groundwater. (claim 23) This embodiment provides a method to gain data in near real-time and to access such data remotely. (claim 23)

Another embodiment of the invention relates to a system **10**, comprising a PRB zone **12** to treat a contaminated groundwater, an in-well sensor **34** located within a gradient of the contaminated groundwater or within the PRB zone **12** to sense a characteristic of the groundwater and a transmitter **32** associated with the sensor **34** in-well to wirelessly transmit a signal concerning the characteristic. (claim 44)

In a PRB, a contaminant is identified. Then the extent, depth, velocity and other contaminate plume characteristics are mapped. A body of biologically or chemically reactive material is placed into a trench or receptacle. The location and extent of the trench or receptacle barrier must be carefully situated so as to provide an effective interception and treatment of the plume. (Specification paragraph [0019])

Hence, in another embodiment, the contaminant plume itself must be characterized as a first step for both designing a correct PRB (both as to content and orientation) and as a first step in determining a correct sensor **34** and its proper placement for monitoring the PRB. First, the contaminant is identified. Then, a plume of the contaminant is mapped: its extent, its depth, velocity and other characteristics are determined. Once the plume extent, content and orientation are determined, the PRB trench is excavated or a receptacle is provided at a position correctly in the path of the plume. A body of appropriate biologically or chemically reactive material is placed into the trench or receptacle. The location and extent of the trench or receptacle barrier are such that the plume of contaminants is caused to pass through the PRB material. (Specification paragraph [0019])

Further once the plume extent, content and orientation are determined and the PRB properly located relative to the plume, (a transect is defined) then according to another embodiment of the invention, sensors **34** can be placed at precise locations to provide accurate monitoring. (Specification paragraphs [0020] and [0021])

Precise placement of sensors **34** within the plume and with respect to the PRB itself permits a comparison of groundwater parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity with parameters within the reactive material of the PRB. If precisely placed, the sensors **34** can provide a baseline

measurement of groundwater characteristics at an up-gradient monitoring point before the groundwater comes in contact with the iron media. Monitoring points within the PRB contact with the plume can indicate performance of the PRB iron media. (i.e., any change in the reducing environment provided by the iron media as evidenced by pH, oxidation-reduction potential). Monitoring points downgradient provide treatment effectiveness. (Specification paragraphs [0022] to [0027])

III. THE APPLIED REFERENCES

A. Misquitta, U.S. Patent No.5,639,380.

Misquitta teaches a pump-and-treat groundwater recovery system:

> In a pump-and-treat operation, the migration of the contaminant plume is controlled by establishing a hydraulic barrier. This is accomplished by boring a well which penetrates into the groundwater aquifer and removing the contaminated groundwater for decontamination.

(Column 1, lines 24 to 29)

> Although a flow meter may be used in the groundwater extraction well to track the pumped water, transducers located in the groundwater extraction well, for instance, are not used since any information obtained from that location would be unreliable with respect to determining both groundwater levels, capture zones, and/or contaminant concentrations.

(Column 1, lines 45 to 51)

Misquitta proposes a control process and system whereby a pump extracts groundwater from a well at a first flow rate, hydrodynamics of the surrounding area are monitored, and the hydrodynamic information is transmitted to a computer controller, which computes a new second flow rate and automatically adjusts the pump to the second flow rate to maintain a desired capture zone. (Column 2, lines 43 to 52) FIG. 5 illustrates a typical embodiment of the Misquitta teaching:

FIG. 5 of Misquitta shows a monitoring device 510 placed within monitoring well 400. The device 510 measures conditions within the well. The information measured at 510 is

transmitted as condition signal 410 to monitor converter 520, which converts condition signal 410 into digital signal 530. Computer controller 540 receives digital signal 530, and, in response to that signal, transmits flow signal 550 to flow converter 560, which converts flow signal 550 into control signal 430. Control signal 430 is transmitted to pump 570 located in groundwater extraction well 110 and varies the pumping rate of pump 570. Line 580 indicates the groundwater level in the aquifer.

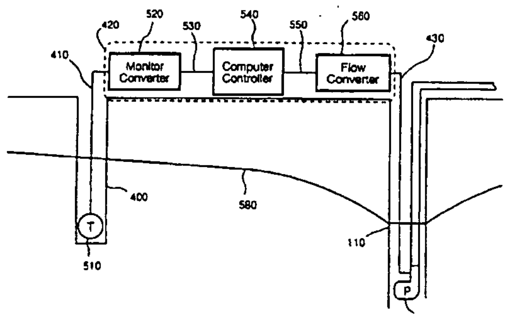


FIG. 5

Misquitta teaches "wireless" above ground signal transmission at column 8, lines 21 to 40 with respect to FIG. 8:

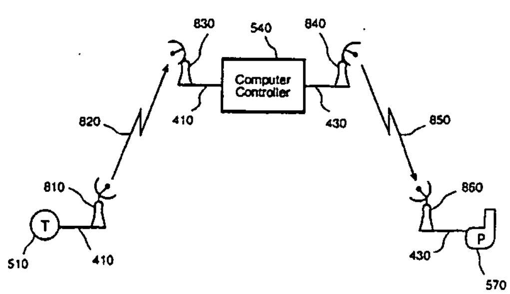


FIG. 8

In yet another embodiment, shown in FIG. 8, condition signal 410 from monitoring device 510 is transmitted by wireless means, such as radio waves, to computer controller 540. Likewise, control signal 430 from computer controller 540 is transmitted by radio waves to pump 570. This embodiment is useful in

sites where the terrain or cost militates against the use of laying down signal runs, for instance, electrical or optical, and thus permits the use of this invention under these constraints.

In particular, condition signal 410 is received by transmitter 810 and transmitted wirelessly, in a form such as by radio waves 820, to receiver 830. Receiver 830 converts the radio waves 820 back to condition signal 410 to be transmitted by wire to computer controller 540. After computer controller 540 calculates the new flow rate, it sends control signal 430 to transmitter 840 which transmits the signal wirelessly, in a form such as by radio waves 850, to receiver 860. Receiver 860 converts radio waves 850 back to control signal 430 and transmits control signal 430 to pump 570, which responds by changing its pumping rate.

(Column 8, lines 21 to 40)

B. EPA "Field Applications of In Situ Remediation Technologies: Permeable Reactive Barriers" ("PRB paper")

The PRB paper is a report by Environmental Management Support, Inc. to document pilot demonstrations of technologies for remediating contaminated ground water. The PRB paper states that "[t]he convention approach for remediating contaminated ground water has been to extract the contaminated water, treat it above ground and inject or discharge the clean water in a process known as "pump and treat" (pages ii and iii). The PRB paper documents "pilot demonstrations and full-scale applications to extract contaminated water in place or increase the solubility and mobility of contaminants to improve their removal by other remediation technologies." (Page iii)

The PRB paper teaches a PRB method:

A PRB is a passive *in situ* treatment zone of reactive material that degrades or immobilizes. contaminants as ground water flows through it. Pros are installed as permanent, semi-permanent, or replaceable units across the flow path of a contaminant plume. Natural gradients transport contaminants through strategically placed treatment media. The media degrade, sorbs, precipitate, or remove chlorinated solvents, metals, radionuclide, and other pollutants. These barriers may contain reactants for degrading volatile organics, cheaters for immobilizing metals, nutrients and oxygen to enhance bioremediation, or other agents.

Page 2, lines 10 to 16.

The PRB paper teaches "[d]edicated in situ flow sensors and ground-water monitoring wells... to track performance" (page 16); monitoring based on pH and Eh (oxidation-reduction potential) (page 13, paragraph 3); zero valet iron as a reactive barrier material (page 5, paragraph 4); forming the PRB by digging a trench, placing reactive material within the trench and conducting PRB treatment with the trench in the path of the contaminated plume (page 2, paragraph 4); upgradient and downgradient monitoring wells (page 5, paragraph 5) along a transect "parallel to the ground-water flow" (page 61, paragraph 6); monitoring wells with open screen intervals (page 42, paragraph 4) and adjusting treatment according to monitoring data (page 20, paragraphs 1 to 4).

In its entirety, the PRB paper states at pages 24 to 25:

> A permeable reactive barrier (PRB) was installed in April 1998 at the U.S. Department of Energy's Kansas City Plant in Kansas City, MO.
>
> Site Background c
>
> Contaminants of concern include 1,2-dichloroethylene (1,2-DCE) and vinyl chloride (YC). Maximum initial concentrations encountered at the site were 1,377 μg/L of 1,2-DCE and 291 μg/L of VC.
>
> The Kansas City Plant site is underlain by alluvial sediments that range from 20-33 ft in thickness. Lower alluvial sediments are characterized by low plasticity clays that overlie basal gravels. The alluvial sediments are underlain by bedrock shales. The basal gravel is the most permeable unit and acts as a semi-confined aquifer. The hydraulic conductivity of the basal gravel is 34 ft/day, while the hydraulic conductivity of the overlying clay unit is 0.75 ft/day.
>
> Technology Application
>
> The PRB was constructed as a continuous trench measuring 130 ft long. Sheet piles were driven into bedrock to support the side walls. The resulting excavation was 6 ft wide. The first 6 ft of the trench above bedrock was filled with 100% zero-valet iron (FeO). The remainder of the trench was filled with 2 ft of Fe and 4 ft of sand. These differing thicknesses were used to compensate for the increased flow-through thickness required for the basal gravel unit. Approximately 8,32Qcubic feet of reactive iron was used in the permeable barrier.
>
> Cost

Design costs were approximately $200,000. Design costs included pre-design site characterization done to obtain additional chemical, hydrological, and geotechnical data. Installation costs were $1,300,000. This includes construction, materials, the reactive material, and hazardous waste transportation and disposal.

Results

Cleanup goals for the site are Maximum Contaminant Levels (MCLs) as defined in 40 CFR 141.2 andl isted in 40 CFR 141.61(a) and 40 CFR 264.94. (70 Jlg/L for 1,2-DCE and 2 Jlg/L for VC)

The VOC plume is predominant in the basal gravel unit. A number of monitoring wells have been installed. Upper completion wells are screened in the saturated clay. The clay soil extends from the ground surface to a depth of approximately 25 ft. Lower completion wells are screened in the basal gravel formation which varies in thickness from about 3-5 ft and overlays the bedrock (shale). Lower completion wells were installed at the upgradient face, center, and downgradient face of the wall at three locations. Side gradient wells were installed as well to confirm that the contamination is not going around the wall. Results of a January 16, 1999, sampling event indicate that all compliance wells are below MCLs.

Plans call for investigative fieldwork to be conducted at the PRB in February 1999. This will include subjecting a number of the wells to colloidal borescope measurements, heat-pulse flow meter measurements, and enhanced (nitrogen pressure) single well testing in order to address the following questions:

> Can flow rates and directions within an iron wall be adequately determined? Are there significant flow contrasts within the treatment area? Can the enhanced single-well testing procedure adequately determine permeability contrasts within the treatment zone? How do the borescope, heat-pulse meter, and enhanced single-well testing procedures compare with respect to ease-or-use and precision of measurement?

Lessons Learned

The two mall advantages for choosing the continuous permeable wall design were predictability and eccentrics.

A continuous permeable wall impacts the existing ground-water flow system less than some other designs. Modeling (predicting) "changes" in flow directions and velocities were not required for this design as would have been for a funne.1.,and-gate system. The upgradient horizontal extent of the plume and ground-water levels are expected to experience little change.

The cost and time required for constructing a continuous permeable reactive wall was estimated to be less than for constructing a series of impermeable wall and gate sections. The continuous wall was expected to be constructed with a one-pass deep trenching machine. However, the contractor had difficulties with the~ trenching machine, which may have been due to the heavy, wet clay.. The problems encountered resulted in utilization of conventional sheet pile construction of the permeable wall. This should actually benefit the long-term performance. For example, there was better opportunity during the installation process to verify intimate contact of iron placement with the bedrock surface; additional wall thickness was....

Page 91, paragraphs 2 to 4 and page 20, paragraphs 1 to 4 in their entirety, read:

Numerous geochemical, hydrological, and other factors that affect uranium removal efficiencies and processes in each of the Pros are currently being evaluated. These factors include:

Changes in the amount arid velocity of water flowing through the Pros

Type and quantities of minerals forming within the Pros Leakage between underlying "no-flow" paths through the Pros

The following potential problems also are being assessed:

> In a low-gradient system like Fry Canyon, it is difficult to estimate mass of treated water and, at times, whether there is even flow through some of the gate structures. This presents an unknown to regulators in estimating total mass of contaminant. that will be cleaned up per unit of time since PRB deployment~ Seasonal changes are apparent in the Pros' efficiency in removing uranium. The processes causing these changes need to be identified in order to effectively determine long-term clean-up goals.
>
> Pros that are placed adjacent to ephemeral channels could be destroyed or have their long-term function significantly compromised during intense thunderstorm events in the Fry Creek drainage basin without proper erosion control measures. Ground settling could compromise the lack of visual impact that Pros have in future remediation applications and could impact monitoring wells.

Page 91, paragraphs 2 to 4.

Cleanup goals for the site are o.oo5 mg/L for TCE, 0.070 mg/L for cDCE and 0.002 mg/L for VC. After months of system operation, positive indicators for dechlorination were measured at downgradient monitoring wells for both VOC concentrations and indicator compounds (pH, eH, chloride). However, due to the slow rate of ground-water flow and the fact that VOCs were present downgradient of the wall at installation, performance evaluations continue. Construction of Phase 2 will extend the wall to a total length of 1,000 ft to treat the entire contaminant plume.

> Minor problems were encountered at the start of Phase I installation, with some material cave-in occurring at the top 3-4 ft of the trench sidewalls. This problem was alleviated by reconfiguring the location of the feed hopper on top of the boot and by adding steel plates to the top portion of the boot, to improve material flow. Installation through the two aquifers has affected ground-water flow in the vicinity of the treatment wall. By providing a greater connection between the two aquifers, ground-water velocities have been reduced and ground-water flowpaths modified slightly. The reduction in ground-water velocities and modified flowpaths should not affect the capability of the treatment wall to intercept and adequately treat VOCs at the site. Increased residence time for treatment will improve the long term treatment efficacy.
>
> Modifications to the ground,-water monitoring schedule were also necessary to take into account differences in ground-water flow rates. Sampling upgradient and downgradient of the wall is conducted on a quarterly basis. Semi,-annual sampling is anticipated in the future.
>
> Lessons Learned
>
> Compared with other methods, continuous trenching provided cost- effective installation and a high degree of confidence that materials would be placed according-to the design, to create a continuous treatment wall with equal distribution of the Fe^0.

Page 20, paragraphs 1 to 4.

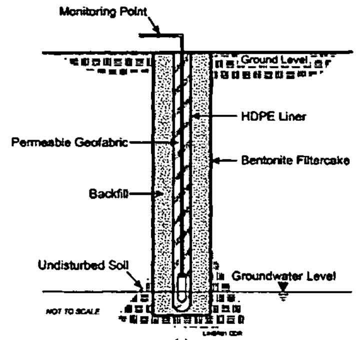
C. US Army Corps of Engineers, "Design Guidance for Application of Permeable Barriers to Remediate Dissolved Chlorinated Solvents" ("Corps of Engineers paper(s)")

At page v, the Corps of Engineers paper(s) distinguishes a PRB method from pump-and-treat. "Unlike conventional ex situ technologies, such as pump-and-treat systems, in situ technologies are more dependent on site-specific parameters" (page v, lines 13 to 15). The Corps of Engineers paper(s) then describes prior art PRB methods:

> In its simplest form, a permeable barrier consists of a trench in the path of the dissolved chlorinated solvent plume. This trench is filled with a reactive medium, such as granular iron. As the groundwater flows through this continuous reactive barrier, the chlorinated organics come in contact with the reactive medium and are degraded. The main advantage of this system is that no pumping or above-ground treatment is required; the barrier acts passively after installation.

Page v, lines 24 to 28.

And at page 69 shows a typical PRM monitoring well:



Page 69.

The monitoring wells have a PVC casing (p.78) and as shown in the page 69 figure include a Bentonite filtercake surrounding a conduit for raising a sample to ground surface. The conduit includes a high density polyethlene liner (HDPE) and permeable geofabric and the conduit (not identified).

Relative to sampling, the Corps of Engineers paper teaches:

> When collecting groundwater samples from the reactive cell or pea gravel, traditional methods involving purging several casing or pore volumes of water prior to collection should be avoided. Such practices may capture water that represents a significantly lower residence time in the reactive cell. Rapid withdrawal of a water sample by any sampling method may draw water quickly from the upgradient direction, and such water may have been incompletely treated by the reactive medium. Analyzing a mixture of water from locations partially outside of the monitoring well screen could suggest higher levels of the target analytes than actually exist. Alternative sampling methods that are expected to yield more representative water samples in a permeable barrier have been discussed by Warner et al. (1996) and Kearl et al. (1994). Examples of potentially favorable groundwater sampling techniques include the following:
>
> Purge small volumes of casing water (micropurging) before collecting the sample. Water is extracted at very low rates for both purging and sampling to minimize disturbance of the pore water. This prevents groundwater that has not had sufficient residence time From being drawn into the sample.
>
> Use packers to isolate nonrepresentative casing water from the flow system.
>
> Sample symmetrically along the flow direction to avoid setting up artificial gradients.

> Progressively remove samples from the downgradient direction toward the upgradient direction to minimize potential cross-contamination by the sampling equipment.

Page 81, lines 9 to 28.

IV. ISSUES

The issues on appeal are (i) whether the subject matter of claims 1 to 35 and 44 to 66 would have been obvious under 35 U.S.C. §103 over the PRB paper and Misquitta and (ii) whether the subject matter of claims 1 to 35 and 44 to 66 would have been obvious under 35 U.S.C. §103 over the Corps of Engineers paper(s) and Misquitta.

V. GROUPING OF CLAIMS

For the purposes of this appeal and 37 C.F.R. §1.192(c)(7), the rejected claims are grouped as follows:

Group I	-	Claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65
Group II	-	Claims 2 and 47
Group III		Claims 3 and 48
Group IV	-	Claims 4 and 49
Group V	-	Claim 6, 26 and 52
Group VI	-	Claim 7, 27 and 53
Group VII	-	Claim 8, 28 and 54
Group VIII	-	Claim 9
Group IX	-	Claim 10 to 14
Group X	-	Claim 16

Group XI - Claims 23 to 25 and 29 to 43

Group XII - Claim 62

The claims of Groups I to XV do not stand or fall together and are separately patentable and are separately discussed in the argument below.

VI. ARGUMENT

Claims 1 to 35 and 44 to 66 were rejected under 35 U.S.C. §103 over the PRB paper and Misquitta and claims 1 to 35 and 44 to 66 were rejected under 35 U.S.C. §103 over the Corps of Engineers paper(s)s and Misquitta.

GROUP I - CLAIMS 1, 5, 15, 17 TO 22, 44 TO 46, 50, 51, 55 to 61 AND 63 to 65

A. Improper Combination of References

The PRB paper and the Corps of Engineers paper(s) relate to a PRB method. A PRB method is a passive method that depends upon "natural groundwater flow" and a correct mapping of the flow for effectiveness.

The Misquitta reference relates to a pump-and-treat groundwater recovery system. In contrast to a passive, natural groundwater flow PRB method, a pump and treat method is designed to disrupt natural groundwater flow by diverting ground water to the above ground surface for treatment. A reference that teaches a disruptive pump-and-treat method is not "reasonably pertinent" to a passive, natural flow method. The references are not properly combinable as analogous art. See *In re Clay*, 23 USPQ2d 1058, 1060 (Fed. Cir. 1992).

Further, to support a rejection based on a combination of references, "[t]he PTO "must not only assure that... requisite findings are made, based on evidence of record, but must also *explain the reasoning by which the findings are deemed to support the agency's conclusion*" (emphasis added). *In re Lee*, 61 USPQ 2d 1430, 1434, 277 F.3d 1338, 1343 (Fed. Cir. 2002).

To establish a prima facie case of obviousness based on a combination of references, the

PTO must provide an:

> ...objective teaching... [that] would lead [one skilled in the art] to combine the relevant teachings of the references." In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992)
>
> ... "When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the Graham factors)."
>
> ....
>
> ...The Board [PTO] must identify specifically the principle, known to one of ordinary skill that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references").

In re Lee, supra 277 F.3d at 1343 , 61 USPQ 2d at 1433-1434.

Apparently in response to this important requirement, the PTO states in the April 23, 2003 Final Rejection:

> In this case, Misquitta specifies that automation is a benefit for remediation projects in col 2 lines 40-42, and examiner notes that costs for labor and manpower are a factor always considered in long-term projects, especially when the site is likely to be remote and hazardous, as contaminated sites usually are, as disclosed in col 8 lines 25-29.

Final Rejection page 15.

This argument is incorrect for a number or reasons. First, economics (costs for labor, etc) are not the technical teachings required by *In re Lee*. The claimed invention is not in the field of economics but is in the technology field of PRB "contaminated aqueous medium" treatment.

The person skilled in the contaminate treatment art would not have been led to a new contaminate treatment by an economics (costs for labor, etc.) teaching.

Second, PRB paper and the Corps of Engineers paper(s) relate to a PRB method. The PTO has not identified a corresponding economics (costs for labor, etc.) need in any of the PRB paper and the Corps of Engineers paper(s) for the person skilled in the art to look to the teachings of the PRB paper or the Corps of Engineers paper(s).

The PTO must provide "logical and rational" reasoning to support its determination (to reject on combined references). *In re Lee, supra* 277 F.3d at 1342, 61 USPQ 2d at 1432-1433. In a scientific field, the "logical and rational" combining reasoning would be based on a scientific suggestion in a corresponding scientific field. The PTO has not provided an *In re Lee* reason to combine teachings from a disruptive pump-and-treat method and system with a critically passive PRB method and system. Unless the PTO can meet the required *In re Lee* "logical and rational" reasoning to combine, the rejection must be withdrawn.

For all these reasons, the rejections under 35 U.S.C. §103(a) over the PRB paper(s) and Misquitta and the Corps of Engineers paper(s) and Misquitta should be overruled.

B. No *prima facie* Case.

Further even improperly combined, the references do not establish a prima facie case of obviousness of "in-well" "wireless communications," claims 1 to 22 or of "a transmitter associated with the sensor in well to wirelessly transmit a signal," claims 44 to 65. The Office Action at page 7 states that "A transmitter... and the method of monitoring and transmitting" is [sic] taught in Misquitta in col. 6 lines 47-60 and col. 7 lines 7-21." Applicants have carefully reviewed Misquitta. While Misquitta discloses a monitor that transmits a signal, the signal is transmitted from "in-well" by wire not "wirelessly." See Misquitta col. 8, lines 41 to 50.

"A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art...." *In re Rijckaert*, 28 USPQ2d 1955, 1956 (Fed. Cir. 1992). The PRB paper(s), the Corps of Engineers paper(s) and Misquitta do not teach or suggest "in-well" "wireless

communications" (claims 1 to 22) or "a transmitter associated with the sensor 12 in well to wirelessly transmit a signal" (claims 44 to 65). "If examination... does not produce a prima facie case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). "When the reference cited by the examiner fail to establish a prima facie case of obviousness, the rejection is improper and will be overturned." *In re Deuel*, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995).

The references do not establish a prima facie of obviousness of claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections under 35 U.S.C. 103 should be overruled.

GROUP II - CLAIMS 2 AND 47

Claim 2 claims "monitoring... conducted by at least one well... about 25 feet up-gradient of the PRB and at least one well... about 25 feet down-gradient." Claim 47 claims a system with "at least one well placed up to about 25 feet up-gradient of the PRB and at least one well placed up to about 25 feet down-gradient of the PRB."

The Final Rejection states that the "PRB papers teach up-gradient and down-gradient monitoring wells in page 5 paragraph 5..." (Final Rejection page 3). The Final Rejection states that "[t]he Corps of Engineers papers teach up-gradient and down-gradient monitoring wells in paragraph 3, page 56 (Final Rejection page 8).

While both statements are correct, the statements do not address claim 2. Neither the PRB papers nor the Corps of Engineers paper(s) teach or suggest wells "about <u>25 feet</u> up-gradient... about <u>25 feet</u> down-gradient..." (emphasis added). Indeed, the Corps of Engineers paper(s) at paragraph 3, page 56 does not teach any upgradient and downgradient monitoring wells; it teaches upgradient and downgradient sections of pea gravel. Neither the PRB papers nor the Corps of Engineers paper(s) establish a prima facie case of obviousness of claim 2 and 47. See *In re Rijckaert*, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993).

The Final Rejection also states that the "PRB papers teach up-gradient and down-

gradient" at "multiple other occurrences" (Final Rejection page 3). This is improper examination. If the PTO is relying on a reference to support its position that "up-gradient and dow n-gradient" (and the claim limitation of "about 25 feet up-gradient... about 25 feet down-gradient...") is obvious, then the PTO must indicate where the "teaching or suggestion" appears in the references. *In re Rijckaert*, supra at 1957.

The Final Rejection page 4 states "[d]esigning the system to meet site requirements is taught in paragraphs 2-4 on page 91 and paragraphs 1-4 on page 20 and would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have located the monitoring wells with in-well sensors 12 in certain locations relative to the contamination, both vertically and horizontally...." However, this conclusion does not logically follow from prior art that does not teach or suggest the particular "25 feet up-gradient... about 25 feet down-gradient" placement of the invention.

The Final Rejection page 4 also states that "since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. In re Aller, 105 USPQ 233." In re Aller relates to parameter ranges that encompassed claimed ranges. The situation here is that Applicant is claiming untaught limitations. No prima facie case is made by the PTO where the claims claim untaught limitations. "When the reference cited by the examiner fail to establish a prima facie case of obviousness, the rejection is improper and will be overturned." *In re Deuel, supra.*

Additionally, the rejections of claims 2 and 47 are improper for the same "combination of references" argument to the rejections of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

For all these reasons, the rejections of claim 2 and 47 should be overturned.

Group III - Claims 3 and 48

Claim 3 claims "monitoring... by at least one well placed about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient..." and

claim 48 claims a system "comprising at least one well about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient...."

First, the rejections of claims 3 and 48 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

Further even improperly combined, the references do not establish a prim facie case of obviousness. *See In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The Final Rejection rejects claims 3 and 48 but fails to identify any disclosure of the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta that teaches or suggests "at least one well placed about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient...." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not teach or suggest "at least one well placed about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient...." The references do not establish a prim facie case of obviousness of claims 3 or 48. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

The rejections of claims 3 and 48 should be overturned.

GROUP IV-CLAIMS 4 AND 49

Claims 4 and 49 claim "monitoring... by at least one well placed about 2 to about 4 feet up-gradient of the PRB and at least one well placed about 2 to about 4 feet down-gradient...." The Final Rejection rejects these claims but fails to identify any disclosure of the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta that teaches or suggests "monitoring... by at least one well placed about 2 to about 4 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient...." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claim 4. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

Additionally, the rejections of claims 4 and 49 are improper for the same "combination of references" argument to the rejections of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections of claims 4 and 49 should be overturned.

GROUP V - CLAIMS 6, 26 AND 52

Claims 6 and 26 claim monitoring or sensing "by a plurality of in-well sensors arranged substantially along a transect … defined by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of an open screen interval mid point of each well." Claim 52 claims a system, wherein a transect is defined "by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of an open screen interval mid point…."

The importance of sensor placement is described in the specification. Applicant points out in the specification that a PRB is designed to provide a set residence time for decontamination of the contaminated plume. A proper PRB design is determined by concentration of contaminants in the contaminant plume, natural groundwater flow and contaminant degradation rate within the PRB reactive material. The contaminant plume must be properly intercepted by the PRB and the effectiveness of the PRB must be precisely monitored. Up-gradient and down-gradient sensors must be properly placed to provide a comparison of groundwater parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity with parameters within the reactive material of the PRB. An up-gradient monitoring point provides a baseline measurement of groundwater characteristics before the groundwater comes in contact with the iron media. The monitoring points within the iron PRB indicate performance of the iron media. (i.e., any change in the reducing environment provided by the iron media as evidenced by pH, oxidation-reduction potential). The downgradient sensors function to monitor return of the groundwater to a natural state. For example, pH, oxidation-reduction potential and specific conductance can be measured and compared to values at an upgradient well to monitor barrier effectiveness.

According to an embodiment of the invention claimed in claim 6, 26 and 52 it has been found that an exacting PRB monitoring is provided "by a plurality of in-well sensors 12 arranged substantially along a transect ... defined by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of an open screen interval mid point of each well."

The PRB papers, the Corps of Engineers paper(s) and Misquitta do not suggest or appreciate the precise placement found by Applicant and recited in claims 6, 26 and 52 to provide effective barrier monitoring.

The Final Rejection states at page 4:

> Pages 24-25 [of the PRB papers] teach a 6' wide PRB and teaches that the wells placed are along the upgradient face, the center, and the downgradient face, thus within 25 and 6 feet up-and down- gradient of the PRB and including wells within 2 feet of the PRB or within the PRB. A plurality of sensors 12 is taught in page 13, "Results" in that pH and VOC concentrations were measured, and page 37 paragraph 5 teaches water level monitoring, thus at least 2 sensors 12 were used.

and at page 6:

> Examiner notes specifically Corps of Engineers papers section 8.2.1 on page 82 and page 81 section 8.1.2 and section 3.3.1 page 26. The Corps of Engineers papers teach up-gradient and down-gradient monitoring wells in paragraph 3 page 56. Fig. 8.1 teaches monitoring wells located along a transect of the PRB zone. A plurality of sensors 12 is taught in page 26, paragraph 2 and page 81 paragraph 2. Monitoring wells have an open screen interval to allow the monitored fluid to flow into the well, as disclosed the Corps of Engineers paper(s) section 8.

But the Final Rejection does not state that the references teach or suggest sensors 12 arranged along "a ± 20 feet wide horizontal plane that transcribes... [wells] at ± 5 feet [level] of an open screen interval mid point..." The Final Rejection rejects claims 6, 26 and 52 but fails to identify any disclosure of the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta that teaches or suggests "a ± 20 feet wide horizontal plane that transcribes... [wells] at ± 5 feet [level] of an open screen interval mid point..."

Indeed, the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta do not teach or suggest "a ± 20 feet wide horizontal plane that transcribes... [wells] at ± 5 feet [level] of an open screen interval mid point..." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claim 6, 26 and 52. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

Additionally, the rejections of claims 6, 26 and 52 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections of claims 6, 26 and 52 should be overturned.

GROUP VI - CLAIM 7, 27 AND 53

Claims 7 and 27 claim monitoring or sensing "by a plurality of in-well sensors arranged substantially along a transect ... defined by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of an open screen interval mid point of each well." Claim 53 claims a system wherein a transect is defined "by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of an open screen interval...."

The importance of sensor placement is described in the specification. According to an embodiment of the invention claimed in claim 7, claim 27 and claim 53, it has been found that an exacting PRB monitoring is provided "by a plurality of in-well sensors arranged substantially along a transect ... defined by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of an open screen interval mid point of each well."

The PRB papers, the Corps of Engineers paper(s) and Misquitta do not suggest or appreciate the precise placement found by Applicant and recited in claim 7 and in claim 53 to provide effective barrier monitoring. Indeed, the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta do not teach or suggest "a ± 10 feet wide horizontal plane that

transcribes... [wells] at ± 3 feet [level] of an open screen interval mid point..." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claims 7, 27 or 53. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

Additionally, the rejections of claims 7, 27 and 53 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections of claims 7, 27 and 53 should be overturned.

GROUP VII - CLAIMS 8, 28 AND 54

Claim 8 and claim 28 claim monitoring or sensing" by a plurality of in-well sensors arranged substantially along a transect ... defined by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1 feet of an open screen interval mid point of each well." Claim 54 claims a system with placement within a transect defined "by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1 feet of an open screen interval mid point of each well."

The importance of sensor placement is described in the specification. According to an embodiment of the invention claimed in claim 8, claim 28 and in claim 54, it has been found that an exacting PRB monitoring is provided "by a plurality of in-well sensors arranged substantially along a transect ... defined by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1feet of an open screen interval mid point of each well."

The PRB papers, the Corps of Engineers paper(s) and Misquitta do not suggest or appreciate the precise placement found by Applicant and recited in claims 8, 28 and 54 to provide effective barrier monitoring. Indeed, the PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta do not teach or suggest "a ± 6 feet wide horizontal plane that transcribes... [wells] at ± 1 feet [level] of an open screen interval mid point..." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness

of claim 8. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

Additionally, the rejections of claims 8, 28 and 54 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections of claims 8, 28 and 54 should be overturned.

GROUP VIII - CLAIM 9

Claim 9 claims "in-well monitoring... by in-well sensors arranged substantially along a transect to a PRB zone." The "transect is defined by flow of contaminated aqueous medium."

First, the rejections of claim 9 are improper for the same "combination of references" argument to the rejections of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

Further even improperly combined, the references do not teach or suggest claim 9. With reference to the PRB papers, the Final Rejection states at page 4:

> Pages 24-25 [of the PRB papers] teach a 6' wide PRB and teaches that the wells placed are along the upgradient face, the center, and the downgradient face, thus within 25 and 6 feet up-and down- gradient of the PRB and including wells within 2 feet of the PRB or within the PRB. A plurality of sensors 12 is taught in page 13, "Results" in that pH and VOC concentrations were measured, and page 37 paragraph 5 teaches water level monitoring, thus at least 2 sensors 12 were used.

Final Rejection page 4.

None of pages 23 to 25 or page 13 the PRB paper teaches or suggests "monitoring... by in-well sensors arranged substantially along a [contaminated flow] transect to a PRB zone."

Additionally with respect to Corps of Engineers paper(s), the Final Rejection states:

> Examiner notes specifically Corps of Engineers papers section 8.2.1 on page 82 and page 81 section 8.1.2 and section 3.3.1 page 26. The Corps of Engineers papers teach up-gradient and down-gradient monitoring wells in paragraph 3

> page 56. Fig. 8.1 teaches monitoring wells located along a transect of the PRB zone. A plurality of sensors 12 is taught in page 26, paragraph 2 and page 81 paragraph 2. Monitoring wells have an open screen interval to allow the monitored fluid to flow into the well, as disclosed the Corps of Engineers papers section 8.

Final Rejection page 6.

The Corps of Engineers paper(s) Fig. 8.1 shows a plume approaching a PRB. Fig. 8.a 1 shows no flow across the PRB. Fig. 8.1 does not show or suggest a transect of the PRB. Fig. 8.1 does not show sensors arranged substantially along a [contaminated flow] transect" of the PRB.

The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claim 9. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

The rejections of claim 9 should be overturned.

GROUP IX - CLAIM 10 TO 14

Claims 10 to 14 claim "determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone," "placing monitoring wells along the flow of contaminated medium" and "conducting the in-well monitoring with the monitoring wells."

First, the rejections of claims 10 to 14 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

Further even improperly combined, the PRB papers, the Corps of Engineers paper(s) and Misquitta do not teach or suggest (1) "determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone" or (2) "placing monitoring wells along the flow of contaminated medium." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claims 10 to 14. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

The rejections of claims 10 to 14 should be overturned.

GROUP X - CLAIM 16

Claim 16 claims "determining nature, extent and velocity of a plume of contaminated aqueous medium." Claim 16 is based on paragraph [0019] of the specification stating:

> In a PRB process, a contaminant is first identified, and a plume of the contaminant is mapped: its extent, its depth, velocity and other characteristics are determined. A trench is excavated or other receptacle is placed in ground. A body of biologically or chemically reactive material is placed into the trench or receptacle. The location and extent of the trench or receptacle barrier are such that the plume of contaminant is caused to pass through the PRB material.

Specification paragraph [0019]

With regard to the PRB papers, the Final Rejection page 3 states:

> Re claims 15-16: The PRB papers teach monitoring based on both pH and Eh (oxidation-reduction potential) in page 13 paragraph 3. Pages 19-20 teach a site in South Carolina where both pH and eH were monitored to determine effectiveness of remediation.

Final Rejection page 3.

And, with regard to the Corps of Engineers papers, the Final Rejection states:

> Re claims 15-16: The Corps of Engineers papers in page 81 section 8.1.2 and Section 3.3.1 page 26 teach monitoring based on pH and Eh (redox potential) and that it is very important to do so.

Final Rejection page 9.

Neither of the rejections referring to claim 16 is relevant to claim 16. Claim 16 claims defining contaminate plume attributes; the referenced sections of the PRB papers and Corps of Engineers papers relate to a monitoring step.

The PRB papers, the Corps of Engineers papers and Misquitta do not teach or suggest "determining nature, extent and velocity of a plume of contaminated aqueous medium." The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claim 16. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

Additionally, the rejections of claim 16 are improper for the same "combination of references" argument to the rejection of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

The rejections of claim 16 should be overturned.

GROUP XI - CLAIMS 23 TO 25 AND 29 TO 43

The rejections of claims 23 to 25 and 29 to 43 are based on a combination of the Misquitta reference with either the PRB papers or the Corps of Engineers paper(s). These rejections are based on improper combinations of references. One skilled in the art seeking a non-disruptive solution to a passive PRB treatment method would not have considered the Misquitta disruptive pump-and-treat method. The rejections of claims 23 to 25 and 29 to 43 should be withdrawn for the same "improper combinations of references" reasons of the Group I claims.

GROUP XII - CLAIM 62

Claim 62 claims a system with "a two-way communicator between [a] collector and [a] sensor." The "two-way communicator permits "selection, activation, de-activation, modification, fine-tuning, manipulation or resetting of the sensor."

First, the rejections of claim 62 is improper for the same "combination of references" argument to the rejections of the Group I claims 1, 5, 15, 17 to 22, 44 to 46, 50, 51, 55 to 61 and 63 to 65.

Further even improperly combined, the PRB papers, the Corps of Engineers paper(s) and Misquitta do not suggest or appreciate the functional capability of the two-way collector-sensor communication. The PRB papers and Misquitta or of the Corps of Engineers paper(s) and Misquitta do not teach or suggest "a two-way communicator between [a] collector and [a] sensor" The PRB papers, the Corps of Engineers paper(s) and Misquitta do not establish a prim facie case of obviousness of claim 62. See *In re Rijckaert, supra* 9 F.3d at 1532, 28 USPQ2d at 1956.

The rejections of claim 62 should be overturned.

VII. CONCLUSION

For all the reasons discussed above, it is respectfully submitted that the subject invention would not have been obvious to a person of ordinary skill in the art, at the time the invention was made, in view of the PRB paper and Misquitta or in view of the Corps of Engineers paper(s) and Misquitta.

For all of the above reasons, Appellant respectfully requests this Honorable Board to reverse the rejections of claims 1 to 35 and 44 to 66.

Respectfully submitted,

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__________, 2003

APPENDIX

CLAIMS

1. A method, comprising:

conducting a permeable-reactive barrier (PRB) treatment of a contaminated aqueous medium; and

in-well monitoring by sensing effectiveness of the PRB treatment to generate a signal representing a characteristic of the sensed effectiveness; and

in-well transmitting the signal by a wireless communication to a remote collector or monitor..

2. The method of claim 1, wherein the in-well monitoring is conducted by at least one well placed up to about 25 feet up-gradient of the PRB and at least one well placed up to about 25 feet down-gradient of the PRB.

3. The method of claim 1, wherein the in-well monitoring is conducted by at least one well placed about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient of the PRB.

4. The method of claim 1, wherein the in-well monitoring is conducted by at least one well placed about 2 to about 4 feet up-gradient of the PRB and at least one well placed about 2 to about 4 feet down-gradient of the PRB.

5. The method of claim 1, wherein the in-well monitoring is conducted by a plurality of wells arranged substantially along a transect to a PRB zone.

6. The method of claim 1, wherein the in-well monitoring is conducted by a plurality of in-well sensors arranged substantially along a transect to a PRB zone and the transect is defined by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of an open screen interval mid point of each well.

7. The method of claim 1, wherein the in-well monitoring is conducted by a plurality of in-well sensors arranged substantially along a transect to a PRB zone

and the transect is defined by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of a mid point of an open screen interval mid point of each well.

8. The method of claim 1, wherein the in-well monitoring is conducted by a plurality of in-well sensors arranged substantially along a transect to a PRB zone and the transect is defined by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1 feet of an open screen interval mid point of each well.

9. The method of claim 1, wherein the in-well monitoring is conducted by a plurality of in-well sensors arranged substantially along a transect to a PRB zone, wherein the transect is defined by flow of contaminated aqueous medium.

10. The method of claim 1, comprising determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone, placing monitoring wells along the flow of contaminated medium and conducting the in-well monitoring with the monitoring wells.

11. The method of claim 1, comprising determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone, placing monitoring wells along the flow of contaminated medium and conducting the in-well monitoring with the monitoring wells, wherein at least one monitoring sensor is placed in-well up-gradient of the PRB zone.

12. The method of claim 1, comprising determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone, placing monitoring wells along the flow of contaminated medium and conducting the in-well monitoring with the monitoring wells, wherein at least one monitoring sensor is placed in-well down-gradient of the PRB zone.

13. The method of claim 1, comprising determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone, placing monitoring wells along the flow of contaminated medium and conducting the in-well

monitoring with the monitoring wells, wherein at least one monitoring sensor is placed in-well within the PRB zone.

14. The method of claim 1, comprising determining flow of contaminated aqueous medium up-gradient, down-gradient and transecting a PRB zone, placing monitoring wells along the flow of contaminated medium and conducting the in-well monitoring with the monitoring wells, wherein at least one monitoring sensor is placed in-well up-gradient of the PRB zone, at least one monitoring sensor is placed in-well down-gradient of the PRB zone and at least one monitoring sensor is placed within the PRB zone.

15. The method of claim 1, comprising monitoring effectiveness by measuring at least one of pH, oxidation-reduction potential and specific conductivity.

16. The method of claim 1, comprising determining nature, extent and velocity of a plume of contaminated aqueous medium and conducting the PRB treatment of the contaminated aqueous medium.

17. The method of claim 1, comprising selecting and providing a barrier zone of reactive material and conducting the PRB treatment with the barrier zone.

18. The method of claim 17, comprising excavating a trench suitable for receiving the reactive material and placing the reactive material within the trench to provide the barrier zone.

19. The method of claim 18, comprising locating the trench so that the reactive material therein lies in the path of a plume of the contaminated aqueous medium.

20. The method of claim 1, wherein the in-well monitoring is accomplished with a sensor containing monitoring well located in the vicinity of a PRB zone.

21. The method of claim 1, wherein the in-well monitoring is accomplished with monitoring wells placed up-gradient and down-gradient of a PRB zone.

22. The method of claim 1, wherein the in-well monitoring is accomplished with a monitoring well placed within the reactive material of a PRB zone.

23. A method of treating a contaminated groundwater, comprising:

sensing a characteristic of the contaminated groundwater with a sensor placed in at least one well emplaced substantially along a transect of a longitudinal axis of a PRB zone; and

remotely monitoring the sensing to determine effectiveness of a remediation treatment of the groundwater.

24. The method of claim 23, wherein a characteristic of the contaminated groundwater is sensed with a sensor placed within the well.

25. The of claim 23, wherein a characteristic of the contaminated groundwater is sensed with a sensor placed up-gradient and a sensor placed down-gradient of the PRB.

26. The method of claim 23, wherein the sensors are placed substantially along a transect to a PRB zone and the transect is defined by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of a mid point of each well open screen interval.

27. The method of claim 23, wherein the sensors are placed substantially along a transect to a PRB zone and the transect is defined by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of a mid point of each well open screen interval.

28. The method of claim 23, wherein the sensors are placed substantially along a transect to a PRB zone and the transect is defined by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1 feet of a mid point of each well open screen interval.

29. The method of claim 23, wherein a characteristic of the contaminated groundwater is sensed with a sensor placed up-gradient of the PRB, a sensor placed down-gradient of the PRB and a sensor placed within the PRB.

30. The method of claim 23, comprising adjusting the treatment of contaminated groundwater according to the monitoring.

31. The method of claim 23, wherein the monitoring comprises sensing a contaminant and transmitting a signal concerning the contaminant to a data collector.

32. The method of claim 31, wherein the data collector collects the signal and transmits information concerning the contaminant derived from the signal.

33. The method of claim 32, wherein the collector transmits the information to a remote monitor.

34. The method of claim 33, wherein the information is transmitted over a web connection, phone modem connection, radio connection, network connection, wireless connection, cellular connection, satellite connection, Internet connection or combinations thereof.

35. The method of claim 33, further comprising outputting a contaminant report from the remote monitor.

44. A system, comprising:

a PRB zone to treat a contaminated groundwater;

an in-well sensor located within a gradient of the contaminated groundwater or within the PRB zone to sense a characteristic of the groundwater; and

a transmitter associated with the sensor in well to wirelessly transmit a signal concerning the characteristic..

45. The system of claim 44, additionally comprising a monitor to receive information concerning the characteristic from the sensor.

46. The system of claim 45, wherein the monitor is situated at a location remote from the PRB zone.

47. The system of claim 44, comprising at least one well placed up to about 25 feet up-gradient of the PRB and at least one well placed up to about 25 feet down-gradient of the PRB.

48. The system of claim 44, comprising at least one well about 1 to about 6 feet up-gradient of the PRB and at least one well placed about 1 to about 6 feet down-gradient of the PRB.

49. The system of claim 44, comprising at least one well placed about 2 to about 4 feet up-gradient of the PRB and at least one well placed about 2 to about 4 feet down-gradient of the PRB.

50. The system of claim 44, comprising a plurality of in-well sensors placed within the gradient of the contaminated groundwater or within the PRB zone.

51. The system of claim 50, wherein the sensors of the plurality are located along a transect of the PRB zone.

52. The system of claim 51, wherein the transect is defined by a ± 20 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 5 feet of an open screen interval mid point of each well.

53. The system of claim 51, wherein the transect is defined by a ± 10 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 3 feet of an open screen interval mid point of each well.

54. The system of claim 51, wherein the transect is defined by a ± 6 feet wide horizontal plane that transcribes at least one up-stream monitoring well and at least one down-stream well at a level that is ± 1 feet of an open screen interval mid point of each well.

55. The system of claim 44, further comprising a transmitter associated with a sensor to transmit a signal concerning the characteristic.

56. The system of claim 55, further comprising a collector to receive the signal from the transmitter.

57. The system of claim 56, wherein the collector is capable of transmitting a signal concerning the characteristic to a monitor.

58. The system of claim 57, further comprising a communication link that interconnects the collector and the monitor, the communication link capable of transmitting the signal to enable a user at the monitor to obtain information concerning the contaminant.

59. The system of claim 58, wherein the communication link comprises a web connection.

60. The system of claim 58, wherein the communication link comprises a network.

61. The system of claim 58, wherein the communication link comprises at least one selected from the group consisting of a phone modem connection, radio communication connection, network communication connection, wireless communication system connection, cellular communication connection, satellite communication connection, web connection and Internet connection.

62. The system of claim 58, further comprising a two-way communicator between the collector and the sensor to permit selection, activation, de-activation, modification, fine-tuning, manipulation or resetting of the sensor.

63. The system of claim 58, wherein the sensor comprises at least one selected from the group consisting of a vapor sensor, chemical sensor, fiber optics sensor, acoustic wave sensor solid-state sensor, metal oxide sensor and an electrochemical sensor.

64. The system of claim 44, comprising a plurality of sensors emplaced in a respective plurality of wells arranged substantially along a transect to the PRB zone.

65. The system of claim 44, comprising a plurality of sensors emplaced in a respective plurality of wells arranged substantially along a longitudinal axis of the PRB zone facing flow of the contaminated aqueous medium.

66. A system, comprising:

a PRB zone to treat a contaminated groundwater; <u>and</u>

a sensor located in a monitoring well substantially along a PRB zone transect of flow of the contaminated groundwater from an up-gradient location, across the PRB zone to a down-gradient location.

AUTHORITIES

STATUTE

35 U.S.C. §103

RULE

37 C.F.R. §1.192

CASES

Graham v. John Deere, 383 U.S. 1, 148 USPQ 459 (1966)

In re Clay, 23 USPQ2d 1058, 1060 (Fed. Cir. 1992)

In re Deuel, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995)

In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992)

In re Lee, 61 USPQ 2d 1430, 1434, 277 F.3d 1338, 1343 (Fed. Cir. 2002)

In re Oetiker, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992)

In re Rijckaert, 28 USPQ2d 1955, 1956 (Fed. Cir. 1992)

McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001)